

Evaluation of Academic Computing Assessment Frameworks

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ABSTRACT

Academic computing encompasses the utilisation of staff, infrastructure and services which enable and support the management and delivery of academic programmes in teaching, learning and research. A common academic computing framework allows for future benchmarking within and between higher education institutions in Malaysia. This paper compares nine ICT frameworks using common evaluation criteria. The comparison shows that none of the measurement frameworks fulfil all evaluation criteria. The most obvious non-compliance of the evaluation criteria is that most of the frameworks do not take into account the unique features of Malaysian higher education.

Keywords

Academic computing, assessment, framework

1.0 INTRODUCTION

Since the 1990s, ICT has advanced very rapidly in Malaysia. To a certain extent, what propels ICT to the forefront was the speech by the then Prime Minister of Malaysia, Tun Dr. Mahathir Mohamad in 1991, entitled *Malaysia – the Way Forward*. This document declares for the first time Malaysia's intention to be a fully developed nation by the year 2020 – a concept now widely known as Vision 2020.

To achieve this ambitious goal, many began to look to ICT to provide the required human resources through efficient education and training. Its impact on education, while not yet pervasive, has made considerable inroads. The Ministry of Education (MOE), through its collaboration with various parties, has embarked on various projects related to ICT implementation in

schools. Among these are the Computer-in-Education project, Knowledge Resource Centre, Computer Aided Instruction and Computer Aided Learning, Jaringan Pendidikan, Pusat Sumber Elektronik and the Smart School Project initiated in 1996 (Gan, 2001). The implementation of the nation-wide Smart School project by the MOE and its classification as one of the seven flagship applications further underline the government's emphasis on the role of ICT in education (Multimedia Development Corporation, 2004).

Unlike initiatives at school levels, the implementation of ICT in higher education is generally autonomous and what has been achieved is relatively unknown (Gan, 2001). Research by UNESCO (2004a) found that many Asia-Pacific countries including Malaysia lack the proper framework to measure ICT implementation in higher education. In having such framework, information on various elements of ICT implementation can be gathered and later be used to guide institutions in the planning and deployment of ICT initiatives. A common framework also allows for future benchmarking within and between higher education institutions in Malaysia. As Asia-Pacific countries differ widely in regard to scope and use of ICT in education, it would be unrealistic and inappropriate to use a uniform framework for all. UNESCO recommends that a framework be formulated while taking into account important criteria such as local relevance, reliability and robustness (UNESCO 2004a).

2.0 AREAS OF ACADEMIC COMPUTING

The implementation of ICT in higher education is generally categorised into administrative and academic computing. Administrative computing or administrative technologies describes the use of ICT to support administrative functions of the organisation. Academic

computing or instructional technologies is broadly defined as the use of ICT in teaching, learning and research (Rice & Miller, 2001). More detail definitions by Prupis (1989), Ferrer and Corya (1990), Van Valey and Poole (1994), Nielsen et al. (1995) and Carleton University (2001) describe academic computing as the application of ICT to support the primary activities of higher education institution - teaching, learning and research. It involves the utilisation of staff, infrastructure (hardware and software) and services (technology, information content and human resources) which enable and support the management and delivery of academic programmes and research.

The organisation of academic computing is complex and requires many different dimensions to be described properly (Brookeshire, 1989). Various literatures categorise the broad areas of teaching, learning and research into smaller academic computing areas. There are variations in the clustering and labelling of these areas, due to the variations in its organisation and scope implemented at different higher education institutions (Brookeshire, 1989; Cooper 1991). In general, six main areas of academic computing are identified. They are: 1) Teaching and Learning Using ICT; 2) Researching Using ICT; 3) ICT Organisation, Plan, Policies and Evaluation; 4) ICT Infrastructure; 5) Information Services; and 6) Institutional ICT Support.

3.0 ICT ASSESSMENT FRAMEWORKS

Ten ICT assessment and evaluation frameworks for education are described in this paper. The frameworks are summarised in Table 1.

3.1 Code of Practice Quality Assurance in Public Universities in Malaysia

The document "Code of Practice Quality Assurance in Public Universities in Malaysia third edition" published by the Quality Assurance Division, Ministry of Higher Education (2005) contains guidelines on criteria and standards for higher education in Malaysia and the procedures for quality assurance. The code of practice is intended for use by universities in institutional self-evaluation of their educational programmes, and for use by peer review committees and bodies involved in recognition and accreditation of programmes. Within the document, there is a framework that provides some standards and assessment questions on ICT.

3.2 E-learning Readiness in Malaysia

E-learning Readiness in Malaysia is a joint study by the Ministry of Energy, Water & Communication and Open

University Malaysia aimed to find the current state of readiness for eLearning and to address the gaps via policies. Thirty-seven higher education institutions participated in the survey, with responses provided by policy makers, providers, enablers and receivers (Zoraini, 2004).

3.3 UNESCO's Performance Indicators on ICT Use in Education Project

The Performance Indicators on ICT Use in Education Project is a Japan Funds-in-Trust project undertaken by UNESCO Bangkok. The project aims at developing a structure of indicators to measure ICT use and impact in education. Under the project, a set of indicators was proposed during the Consultative Workshop for Developing Performance Indicators for ICT in Education in 2002. These indicators will be used as a basis for policy planning and programme improvements, specifically demonstrating if and how the use and integration of ICT are actually raising educational standards, serving as a catalyst for educational change and empowering teachers and learners (UNESCO, 2004b).

3.4 The Campus Computing Project

The Campus Computing Project was designed as a framework to measure ICT implementation in higher education. Begun in 1990, the Campus Computing Project is the largest continuing study of ICT in American higher education. The framework uses survey data based on the responses provided by senior campus officials, typically the senior institutional technology officer. Analysis from the survey is used to identify ICT trends in higher education as well emerging practices. It also provides institutions a common platform to measure their performance against benchmark information. The Campus Computing Project has been expanded to Asia under the Asian Campus Computing Survey (Campus Computing Project, 2004).

3.5 Becta's ICT and E-learning in Further Education Survey

The ICT and E-learning in Further Education Survey is designed as a framework to measure ICT implementation in higher education. Begun in 1999, the ICT and E-learning in Further Education Survey is the largest continuing study of ICT in UK higher education. The survey was conducted by British Educational Communications and Technology Agency (Becta) on behalf of the Learning and Skills Council. The study takes the form of a survey by questionnaire with the responses provided by senior campus officials (Becta, 2004).

3.6 IFIP's Information and Communication Technology in Higher Education

The document entitled "Information and Communication Technology in Higher Education" was proposed by the International Federation for Information Processing (IFIP) in 2000. The document underlines a framework that describes the development of ICT in higher education. The framework identifies various approaches to the development of ICT. These approaches are related to the situation in a particular institution across all areas related to the growth of ICT in the institutional system. The framework has proposed a matrix to help institutions determine their stage of development in various areas. An institution may find itself more in one area of the matrix while being less involved in other areas (IFIP, 2000).

3.7 Quality on the Line: Benchmarks for Success in Internet-based Distance Education

Quality on the Line: Benchmarks for Success in Internet-based Distance Education was produced by The Institute for Higher Education Policy and sponsored by the National Education Association, the nations' largest professional association of higher education faculty, and Blackboard Inc., a leading Internet education company. The framework identifies 24 benchmarks considered essential to ensuring excellence in Internet-based distance learning. The benchmarks are divided into seven categories of quality measures currently in use on campuses in the United States. These benchmarks distil the best strategies used by colleges and universities that are actively engaged in online learning, ensuring quality for the students and faculty who use it (Institute for Higher Education Policy, 2000).

3.8 International Survey-Online Learning: Strategies, Infrastructure & Initiatives

The Observatory on Borderless Higher Education conducted an international survey of online learning development in Commonwealth universities. The aim is to collate international data from a wide range of universities, but not to publish details of individual institutions. Respondents will receive analysis of survey results and gain access to specially developed benchmark information, enabling institutions to compare their position on a range of variables against national and international trends. This is designed to aid institutional planning and resource allocation (Observatory on Borderless Higher Education, 2004).

3.9 CAUSE/EDUCOM Evaluation Guidelines for Institutional Information Technology Resources

The purpose of the framework is to provide institutions and regional accrediting associations in the United States with evaluation guidelines for IT resources that could use as a reference when developing their own standards for this area. These guidelines have been developed based on accreditation team experiences. They also have been reviewed and endorsed by the CAUSE and EDUCOM Boards, two key organisations in the IT field in higher education (Fleit, 1994).

3.10 Self-assessment for Campus Information Technology Services

The framework was developed by Fleit (1994) to be used as self-assessment of IT services. The questions are arranged into six categories: planning, policies and procedures, facilities and staff, products and services, organisation and external relationships and funding.

Table 1: ICT assessment frameworks across academic computing areas

Assessment Framework	Locale/Level/ Unit of Analysis/ Year of Conception	Assessment Tool (main)	Academic Computing Areas (arranged in columns of similar theme)					
			Teaching & Learning Using ICT	Researching Using ICT	ICT Organisation, Plan, Policies & Evaluation	ICT Infrastructure	Information Services	Institutional ICT Support
1. Code of Practice Quality Assurance in Public Universities in Malaysia (Ministry of Higher Education, 2005)	<ul style="list-style-type: none"> Malaysia Public Universities Organisation 2005 	<ul style="list-style-type: none"> Questionnaire (survey) Standards 	<ul style="list-style-type: none"> Use of ICT in Teaching and Learning E-learning approaches 		<ul style="list-style-type: none"> ICT Policies 	<ul style="list-style-type: none"> Infrastructure 	<ul style="list-style-type: none"> Digital Reference Materials 	<ul style="list-style-type: none"> Institutional Support ICT Training
2. E-learning Readiness in Malaysia (Zoraini, 2004)	<ul style="list-style-type: none"> Malaysia Tertiary Organisation 2004 	<ul style="list-style-type: none"> Questionnaire (survey) 	<ul style="list-style-type: none"> Content Readiness Cultural Readiness 		<ul style="list-style-type: none"> Management Readiness Financial Readiness 	<ul style="list-style-type: none"> Technical Readiness 	<ul style="list-style-type: none"> Content Readiness 	<ul style="list-style-type: none"> Personnel Readiness Learner Readiness
3. Performance Indicators on ICT Use in Education Project (UNESCO, 2004b)	<ul style="list-style-type: none"> Asia Pacific Primary and secondary National and organisation 2002 	<ul style="list-style-type: none"> Performance indicators 	<ul style="list-style-type: none"> ICT Curriculum Learning Process and Outcome 		<ul style="list-style-type: none"> Policy 	<ul style="list-style-type: none"> Technology Infrastructure and Access 		<ul style="list-style-type: none"> Teaching and Teaching Support Staff ICT Curriculum
4. Campus Computing Project (Asian Campus Computing Survey, 2003)	<ul style="list-style-type: none"> United States, Asia Tertiary Organisation 1990 	<ul style="list-style-type: none"> Questionnaire (survey) 	<ul style="list-style-type: none"> Teaching and Learning with IT 	<ul style="list-style-type: none"> Teaching and Learning with IT 	<ul style="list-style-type: none"> IT Planning, Policy and Management 	<ul style="list-style-type: none"> IT/Computer Facilities and Resources 	<ul style="list-style-type: none"> Information Services 	<ul style="list-style-type: none"> IT/Computer Facilities and Resources
5. ICT and E-learning in Further Education Survey (Becta, 2004)	<ul style="list-style-type: none"> United Kingdom Tertiary Organisation 1999 	<ul style="list-style-type: none"> Questionnaire (survey) 	<ul style="list-style-type: none"> Use of ICT in the Teaching & Learning Process 		<ul style="list-style-type: none"> Policy and Strategy 	<ul style="list-style-type: none"> Infrastructure Access to ILT 	<ul style="list-style-type: none"> Teaching and Learning Content 	
6. ICT in Higher Education (IFIP, 2000)	<ul style="list-style-type: none"> International (general) Tertiary Organisation 2000 	<ul style="list-style-type: none"> Rubric 	<ul style="list-style-type: none"> Philosophy of Learning and Pedagogy 		<ul style="list-style-type: none"> Vision Development Plans and Policies 	<ul style="list-style-type: none"> Facilities and Resources 		<ul style="list-style-type: none"> Understanding of the Curriculum Prof. Develop. of Inst. Staff

Table 1: ICT assessment frameworks across academic computing areas (continued)

Assessment Framework	Locale/Level/ Unit of Analysis/ Year of Conception	Assessment Tool (main)	Academic Computing Areas (arranged in columns of similar theme)					
			Teaching & Learning Using ICT	Researching Using ICT	ICT Organisation, Plan, Policies & Evaluation	ICT Infrastructure	Information Services	Institutional ICT Support
7. Quality on the Line: Benchmarks for Success in Internet-based Distance Education (Institute for Higher Education Policy, 2000)	<ul style="list-style-type: none"> • United States • Tertiary (distance education) • Organisation • 2000 	<ul style="list-style-type: none"> • Questionnaire (survey) 	<ul style="list-style-type: none"> • Teaching/ Learning • Course Develop. 		<ul style="list-style-type: none"> • Institutional Support 		<ul style="list-style-type: none"> • Course Structure 	<ul style="list-style-type: none"> • Student Support • Faculty Support
8. International Survey-Online Learning: Strategies, Infrastructure & Initiatives (Observatory on Borderless Higher Education, 2004)	<ul style="list-style-type: none"> • Europe, Canada and South Africa • Tertiary (distance education) • Organisation • 2002 	<ul style="list-style-type: none"> • Questionnaire (survey) 	<ul style="list-style-type: none"> • Programme and Initiatives - Distance E-learning 		<ul style="list-style-type: none"> • Strategy and Policy 	<ul style="list-style-type: none"> • Infrastructure 		
9. CAUSE/EDUCOM Evaluation Guidelines for Institutional Information Technology Resources (Fleit, 1994)	<ul style="list-style-type: none"> • United States • Tertiary • Organisation • 1988 	<ul style="list-style-type: none"> • Questionnaire (self-assessment) 			<ul style="list-style-type: none"> • Institutional Planning • Information Technology Planning • Committee 	<ul style="list-style-type: none"> • Academic Program Support • Management Support • Resources • Access 		<ul style="list-style-type: none"> • Staffing • Resources
10. Self-assessment for Campus Information Technology Services (Fleit, 1994)	<ul style="list-style-type: none"> • US • Tertiary • Organisation • 1994 	<ul style="list-style-type: none"> • Questionnaire (self-assessment) 			<ul style="list-style-type: none"> • Planning • Policies and Procedures • Organisation • Funding 	<ul style="list-style-type: none"> • Facilities and Staff • Products and Services 		<ul style="list-style-type: none"> • Facilities and Staff • Products and Services

4.0 EVALUATION OF FRAMEWORKS

There are generally three assessment/measurement tools used in all the frameworks. They are performance indicators, questionnaires (survey/self-assessment) and rubrics. Some of the questions included in the questionnaires are themselves performance indicators. Frameworks of similar types show similarities, although this is not true for all frameworks and all criteria.

The framework using performance indicators are:

- Performance Indicators on ICT Use in Education Project (UNESCO, 2004b)

The framework using survey questionnaires are:

- Code of Practice Quality Assurance in Public Universities in Malaysia (Ministry of Higher Education, 2005)
- E-learning Readiness in Malaysia (Zoraini, 2004)
- Campus Computing Project (Asian Campus Computing Survey, 2003)
- ICT and E-learning in Further Education Survey (Becta, 2004)
- Quality on the Line: Benchmarks for Success in Internet-based Distance Education (Institute for Higher Education Policy, 2000)
- International Survey-Online Learning: Strategies, Infrastructure & Initiatives (Observatory on Borderless Higher Education, 2004)

The framework using self-assessment questionnaires are:

- CAUSE/EDUCOM Evaluation Guidelines for Institutional Information Technology Resources (Fleit, 1994)
- Self-assessment for Campus Information Technology Services (Fleit, 1994)

The framework using a rubric is:

- ICT in Higher Education (IFIP, 2000)

In 2002, Twinning developed his Computer Practice Framework (CPF) to measure the use of computers in a classroom setting (Twinning, 2002). To evaluate the CPF, Twinning has developed a comprehensive set of multi-point evaluation criteria. For the purpose of this research, the criteria are adapted to focus on ICT use in the context of Malaysian higher education. By evaluating the frameworks based on these evaluation criteria, the strengths and limitations of the frameworks can be analysed, as follows (see summary in Table 2):

Absoluteness: *Does the framework uses absolute measures, which may not be interpreted differently in different contexts?*

All frameworks provide absolute measures that may not be interpreted differently in different contexts by answering very specific questions that address the use of ICT for specific purposes.

Accuracy: *Does the framework provide accurate descriptions regarding the state of ICT implementation?*

In many instances, frameworks using survey questionnaires and performance indicators provide accurate quantitative, logical (yes/no) and qualitative (specification) measures of specific ICT use in academic computing. There are instances, however, that requires respondents of survey questionnaire to give some estimation to required qualitative values based on their understanding and subjective judgement. This situation is similar to frameworks using rubrics to describe different academic computing situations. Such frameworks requires respondents to select the rubric descriptions that give the best fit, resulting in the pre-defined characteristics not accurately reflect the actual situation. The selection is also subject to different interpretation, thus contributing to the inaccuracy of measurement.

Clarity: *Are all the areas of the framework fully and clearly defined?*

All the frameworks fully and clearly describe the dimensions in use by ways of listing of components (survey questionnaires), elaborate description (rubrics) or both (performance indicators and standards).

Context Specific: *Does the framework look at ICT use in the higher education scope and context?*

With the exception of the UNESCO framework, all the frameworks measure certain areas of ICT use in higher education. The UNESCO framework measures ICT at national level, with focus on schools rather than higher education. Except for the Campus Computing framework, none of the other frameworks encompasses the full scope of academic computing, particularly Researching Using ICT. In addition, each framework gives a different emphasis on different areas of academic computing.

Cultural Specificity: *Is the framework based on expectations of educational practice that are specific to the Malaysian HE?*

Except for the framework developed by the Ministry of Higher Education, Malaysia, no other frameworks was developed based on expectations and educational practice that are specific to the Malaysian higher education. Although the many frameworks have been designed to be used in generic environment, they still need to be customised to local settings. The Campus Computing

framework used in the United States has been customised for use in Hong Kong higher education.

Currency: *Will the framework last longer as the technology changes?*

The need to update these ICT frameworks is inevitable as ICT changes very rapidly. However, frameworks that use general references to technologies need not be regularly updated for new technologies. This is particularly true to frameworks that incorporate standards, rubrics or performance indicators. For frameworks incorporating survey questionnaires, they will last longer as long as they do not attempt to identify current trends of specific technologies used in higher education. The Campus Computing framework needs to be updated more frequently than others as it includes a very detail listing of the most current technologies in use.

Discreteness: *Are the areas of the framework orthogonal (discrete in the sense of not overlapping)?*

In general, the areas in all the frameworks are orthogonal. However, there is some overlapping of areas in the Campus Computing and UNESCO framework as some similar and closely related measures are grouped under different areas.

Discrimination: *Does the framework provide a sufficiently rich picture to enable discrimination between contexts?*

The multitude of measures in most frameworks provides a sufficiently rich picture that discriminates ICT implementation between contexts. The IFIP framework, however, does not include enough components that are necessary for achieving discrimination. In addition, they are clustered together to give a general view, rather than providing a rich picture of ICT implementation.

Ease of Use: *Is it easy to apply the framework?*

All the frameworks achieve ease of use through description regarding performance indicators, ready-made survey questionnaires, external data processing and analysis (nationwide surveys) and simple-to-use rubrics.

Generativity: *Does the framework help to inform thinking and thus lead to richer descriptions of implementation?*

The frameworks incorporating survey questionnaires, performance indicators and standards treat the components individually and do not generalise them, making it more difficult to see the larger picture. This is in contrast to rubric based frameworks where they

sufficiently generalise the components to highlight the patterns of ICT implementation in a particular institution.

Guidelines: *Are guidelines provided explaining how to apply the framework?*

Frameworks incorporating performance indicators and rubrics provide clear guidelines on how to apply the frameworks. Frameworks using survey questionnaires do not provide specific guidelines on how to analyse and report the outcome. This, however, is not a problem in nationwide surveys as there is virtually no processing and analysis of measures done at institutional level.

Internal Consistency: *Are the areas and components of the framework internally consistent?*

The rubric frameworks provide consistent description across areas and components. The performance indicators uniformly use quantitative measures. However, there are inconsistencies in the way different components in the survey questionnaires are measured and described. Campus Computing and Becta questionnaire use different rating scales to represent different measures within the same framework.

Intuitiveness: *Does the framework (and its areas/components) seem right – have an intuitive feel to it (them)?*

All the frameworks (and its areas) seem right; they have an intuitive feel to them. The labels used in the framework are descriptive of the areas they represent.

Quantitative: *Does the framework take into account the quantitative measures of IT use?*

The performance indicators are mainly quantitative measures. The survey questionnaires include both quantitative and qualitative measures. The rubrics and standards are mostly qualitative in nature and they are subject to varying interpretation. For example, the IFIP framework characterises an institution with limited peripherals as going through the Applying stage in the Facilities and Resources area, without quantifying the term “limited”.

Simplicity: *Does the framework have a small number of areas/components? Does each of the areas or components add clarity or richness to the description?*

The frameworks incorporating performance indicators and rubrics use a small number of indicators/descriptors to represent each area/stage of ICT development. In contrast, the survey questionnaires use a very large number of

components. Although they are clustered into areas, there is no generalisation to simplify the measures.

Value Free: *Does the framework enshrine implicit or explicit views of the quality of the practice being described?*

The performance indicators and survey questionnaire frameworks do not subscribe to particular views regarding best practices. However, the IFIP framework using rubric subscribe to the constructivist views regarding the best practices in teaching and learning.

Wholeness: *Are the areas and components explicitly linked together in a way that provides one holistic picture?*

All the frameworks link together different areas and components. However, the interrelationships between areas/components are not explained.

Table 2: Summary of Framework Evaluation

Criteria	Types of frameworks		
	Performance indicators (1 f/work)	Q/naire (8 f/works)	Rubric (1 f/work)
Absoluteness	Yes	Yes	Yes
Accuracy	Yes	Mixed	No
Clarity	Yes	Yes	Yes
Context Specific	No	Yes	Yes
Cultural Specificity	No	Mixed	No
Currency	Yes	Mixed	Yes
Discreteness	No	Mixed	Yes
Discrimination	Yes	Yes	No
Ease of Use	Yes	Yes	Yes
Generativity	No	No	Yes
Guidelines	Yes	Yes	Yes
Internal Consistency	Yes	Mixed	Yes
Intuitiveness	Yes	Yes	Yes
Quantitative	Yes	Mixed	No
Simplicity	Yes	No	No
Value Free	Yes	Yes	No
Wholeness	Yes	Yes	Yes

5.0 CONCLUSION

Analysis in the previous section shows that none of the measurement frameworks fulfil all evaluation criteria. Each type of framework displays specific strengths and limitations. The most obvious non-compliance of the evaluation criteria is that none of the frameworks takes into account the unique features of Malaysian higher education. As a result, the frameworks can be of used to

measure certain aspects of academic computing, but the validity of the measured items is questionable.

Further research needs to be undertaken to understand higher education academic computing in Malaysia. The research needs to identify the components in all areas of academic computing and their levels of importance. Performance indicators that represent the components needs to be developed while taking into account the issues of relevance and practicality in their application. A framework that combines the strengths of the three types of measurement frameworks needs to be formulated. Tools and guides to assist and simplify the application of the framework should be developed. For the purpose of benchmarking, a centralised effort is needed to organise and implement a nationwide survey involving the more than 600 higher education institutions in Malaysia. The survey information can be used to identify the general state of academic computing and its patterns of implementation. This information can assist higher education institutions in providing quality education to fulfil the various needs in the country and remain competitive in a global knowledge industry .

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